

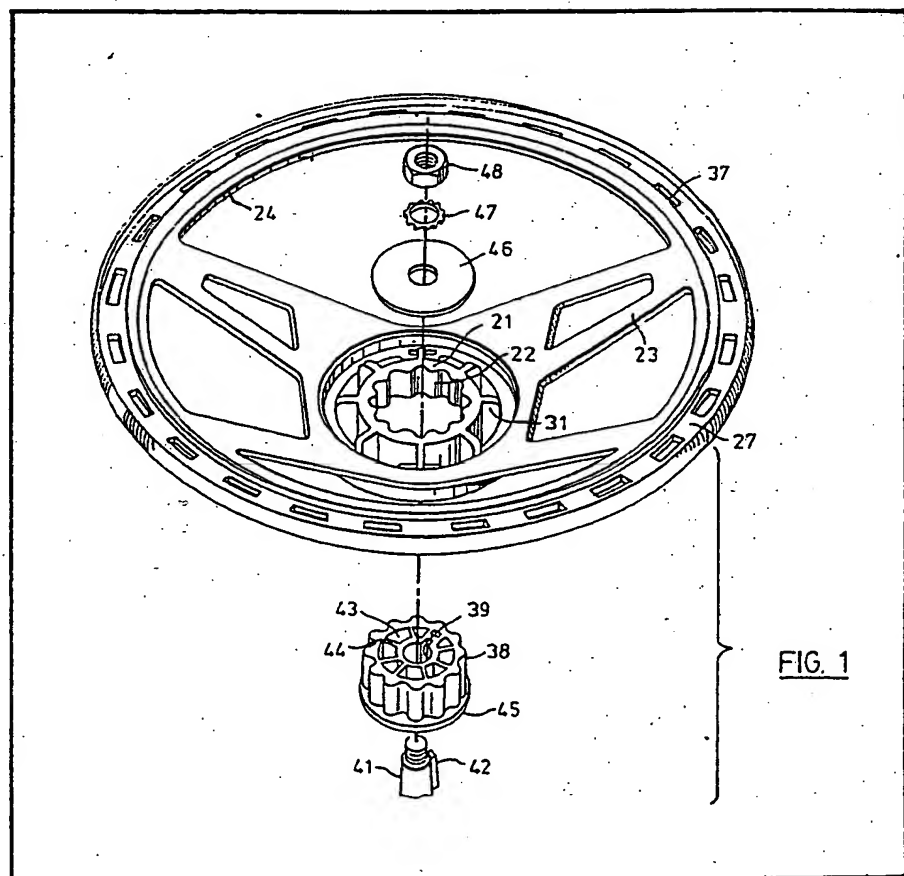
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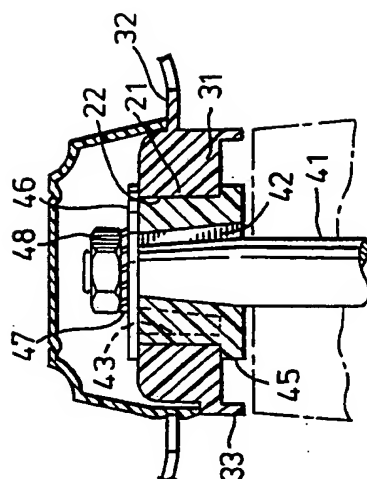
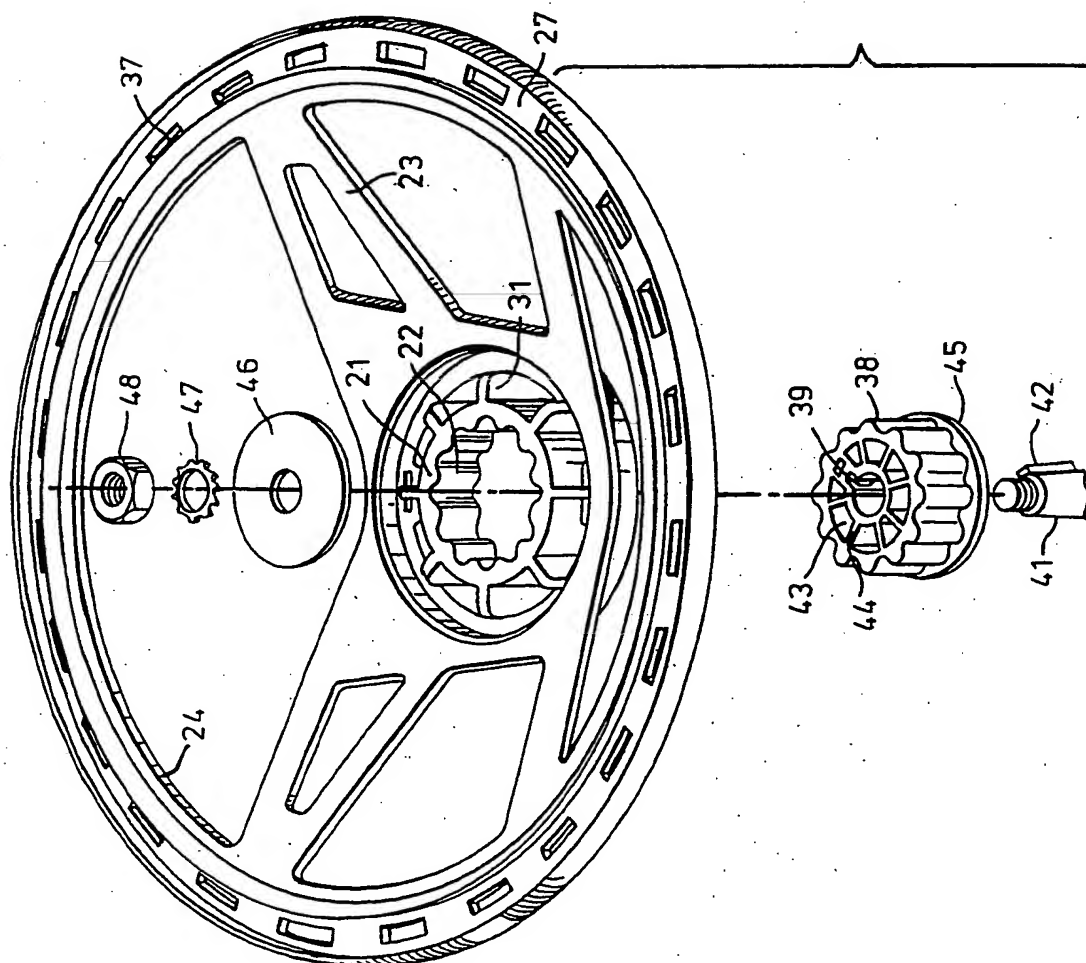
## (54) Steering Wheel

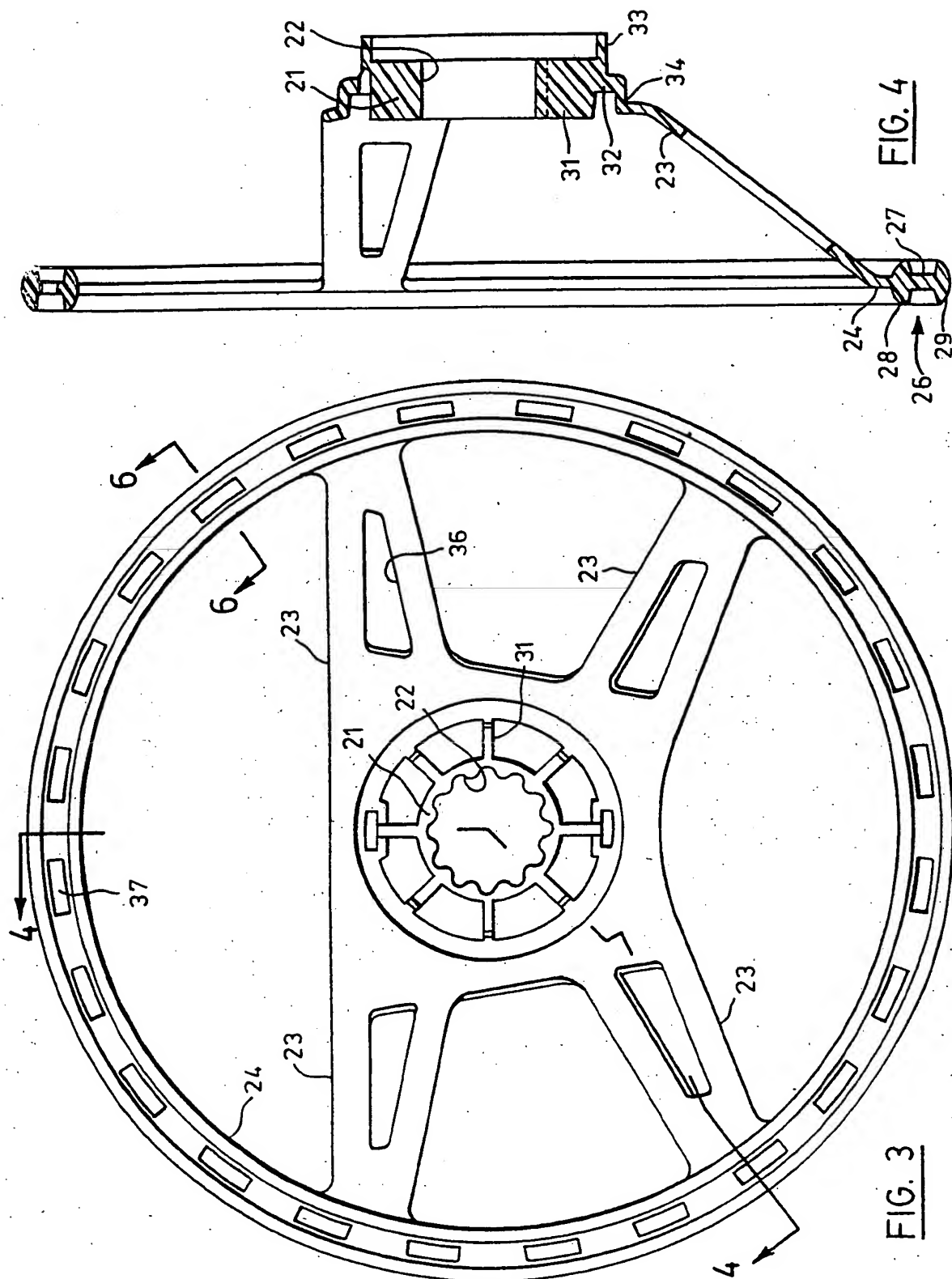
(57) A steering wheel formed as a one-piece molding or casting of plastics or metal material has an apertured hub portion 21, radiating spokes 23, and a circular rim portion having circumferential edge flanges for gripping in the hands, the flanges being connected by an intermediate web 27. This provides good properties of compressive and flexural strength and facilitates attachment of various forms of decorative trim to the rim of

the wheel so that with one basic molding or casting a variety of wheels of distinctive appearance can be produced. An adapter 38 is used to connect the wheel to the steering column 41 so that the wheel can be adapted to different kinds of column and may be secured to the column with a single fastener element e.g. a nut 48. The wheel may also comprise a rim portion having one or more longitudinal channels for receiving a decorative trim element or a secondary molding.



UDC 621.034.4





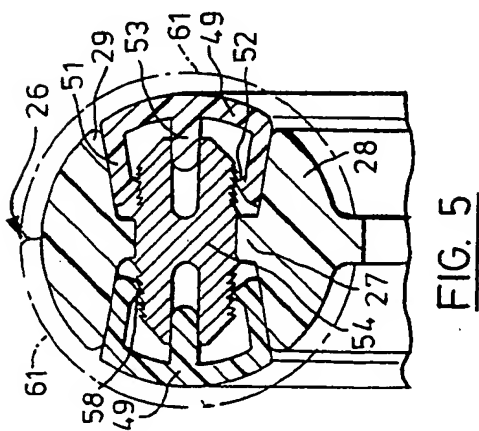


FIG. 5

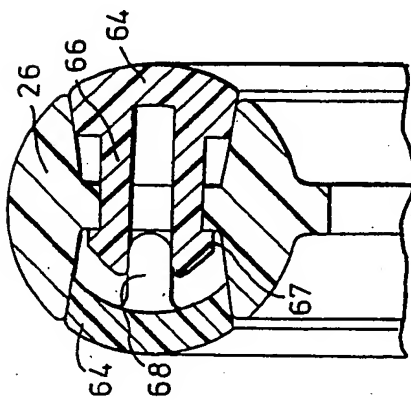


FIG. 6

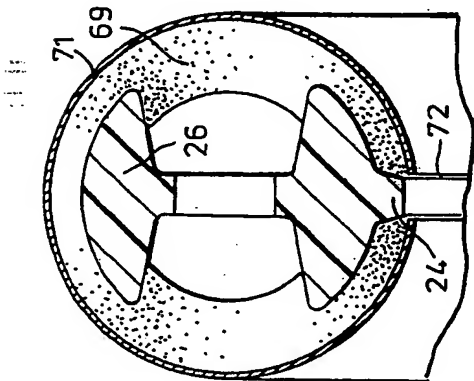


FIG. 7

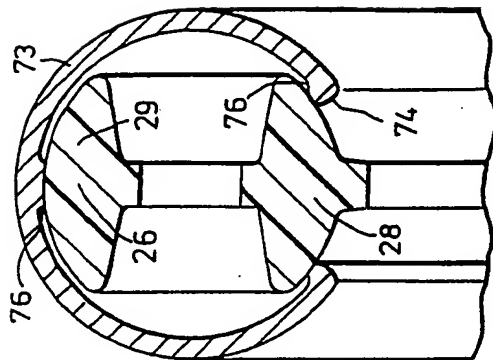


FIG. 8

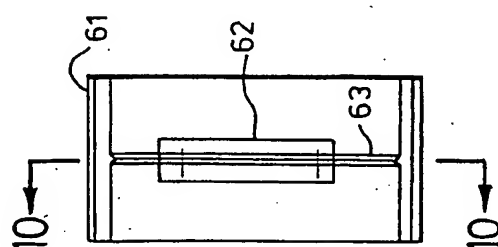


FIG. 9

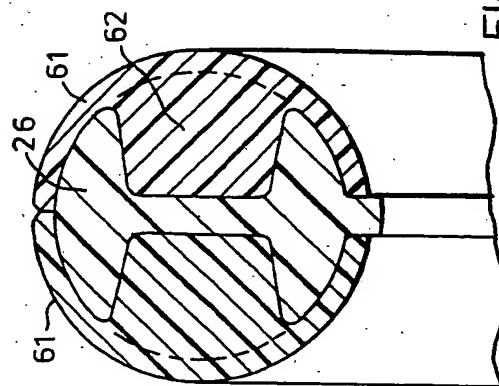


FIG. 10

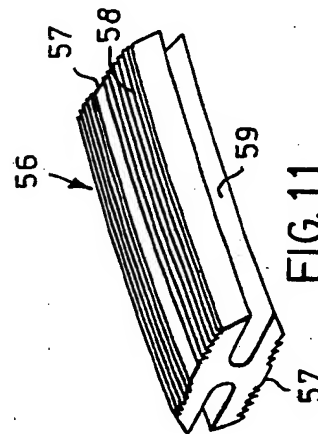


FIG. 11

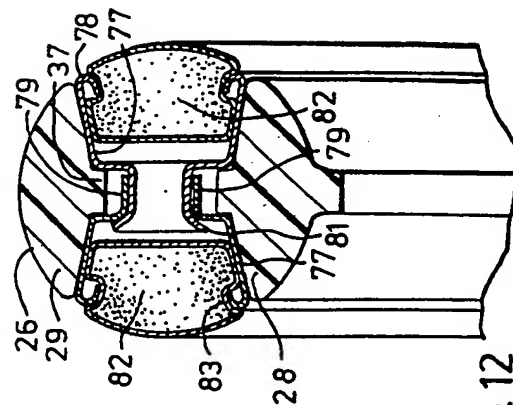
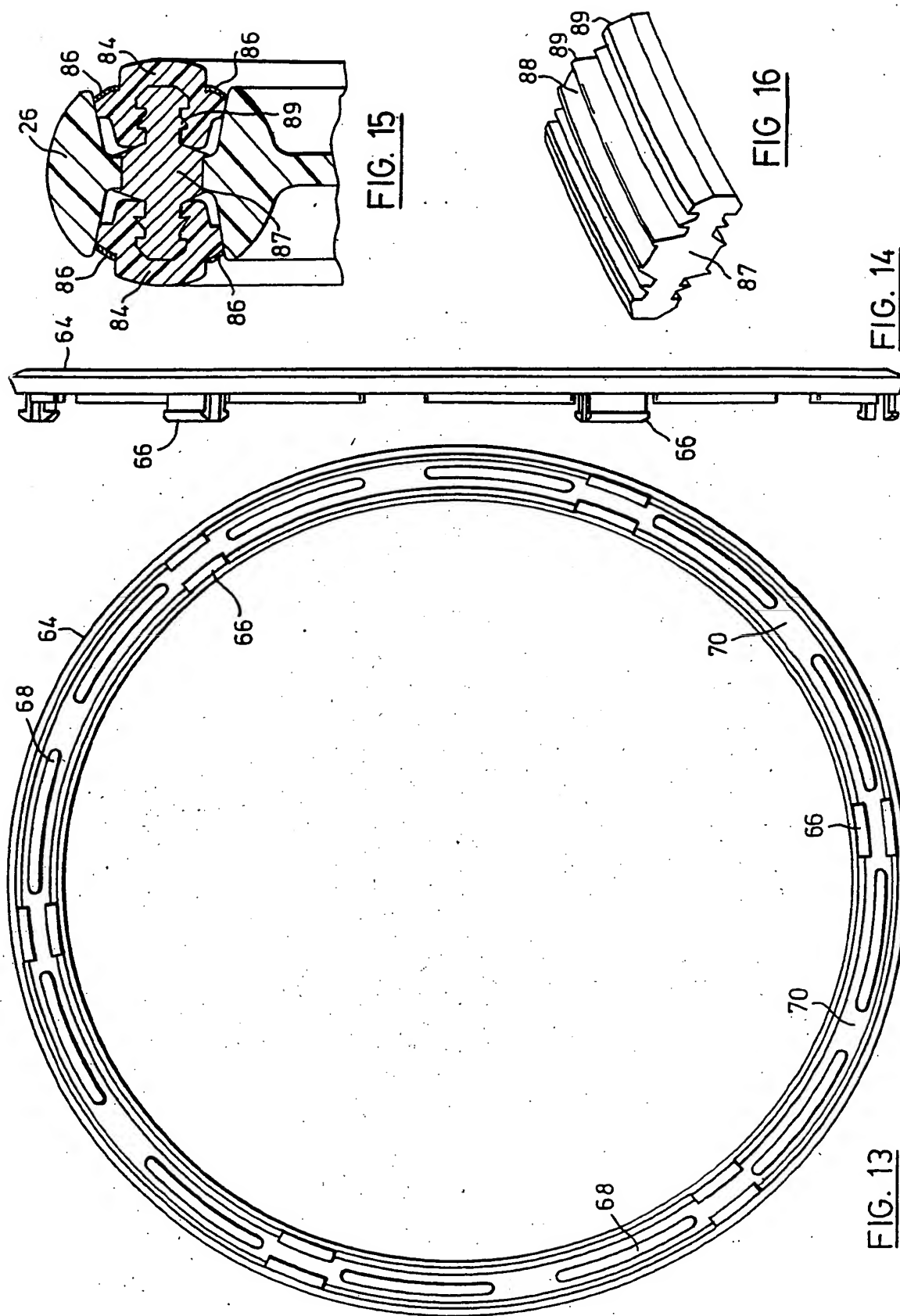


FIG. 12



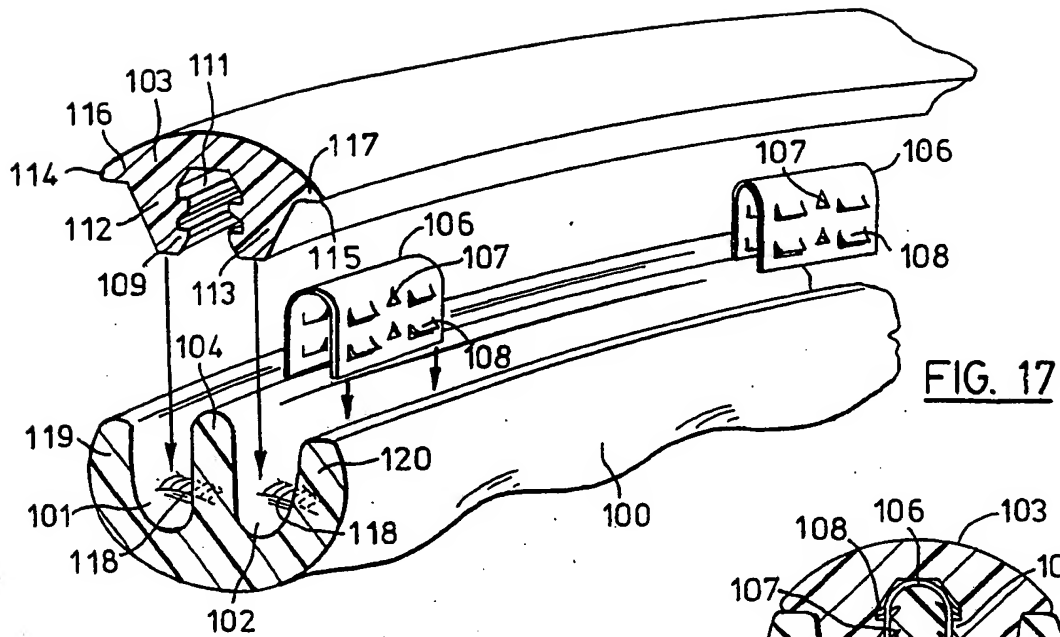


FIG. 17

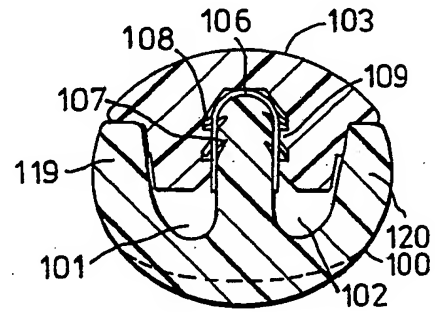


FIG. 18

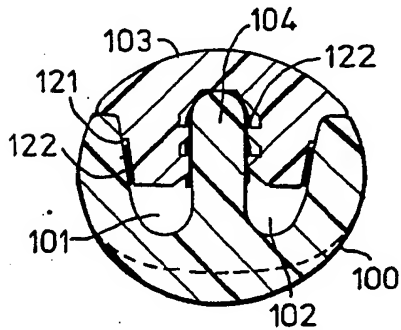


FIG. 19

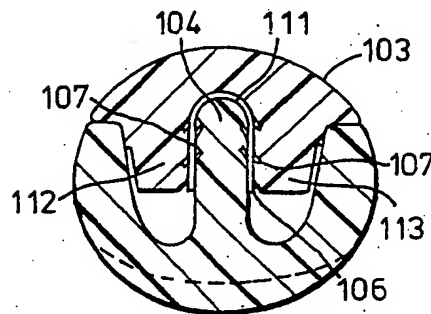


FIG. 20

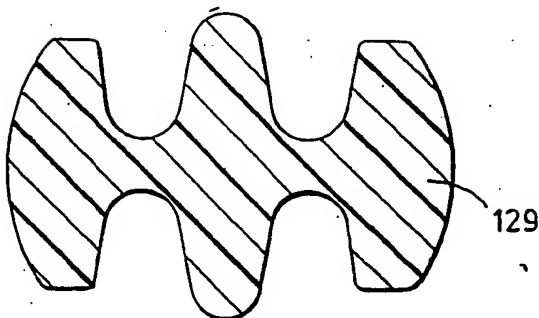
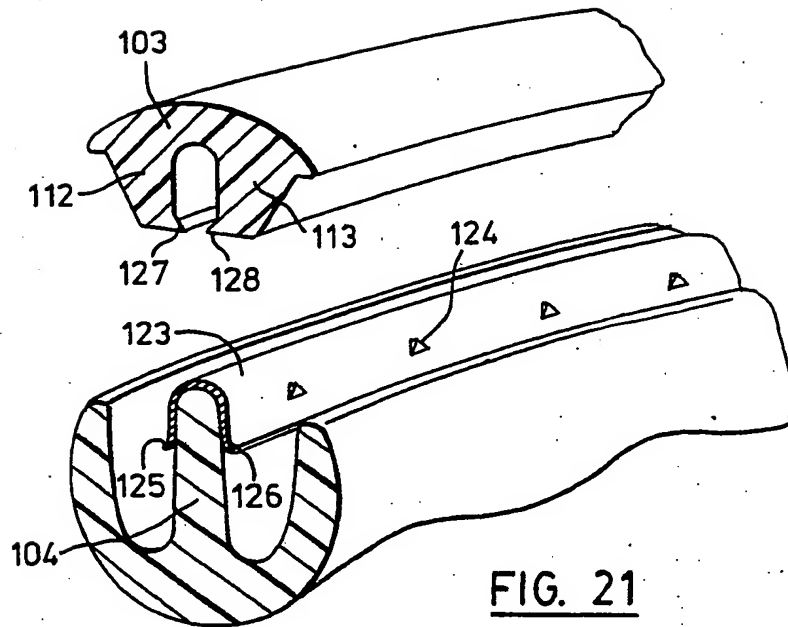
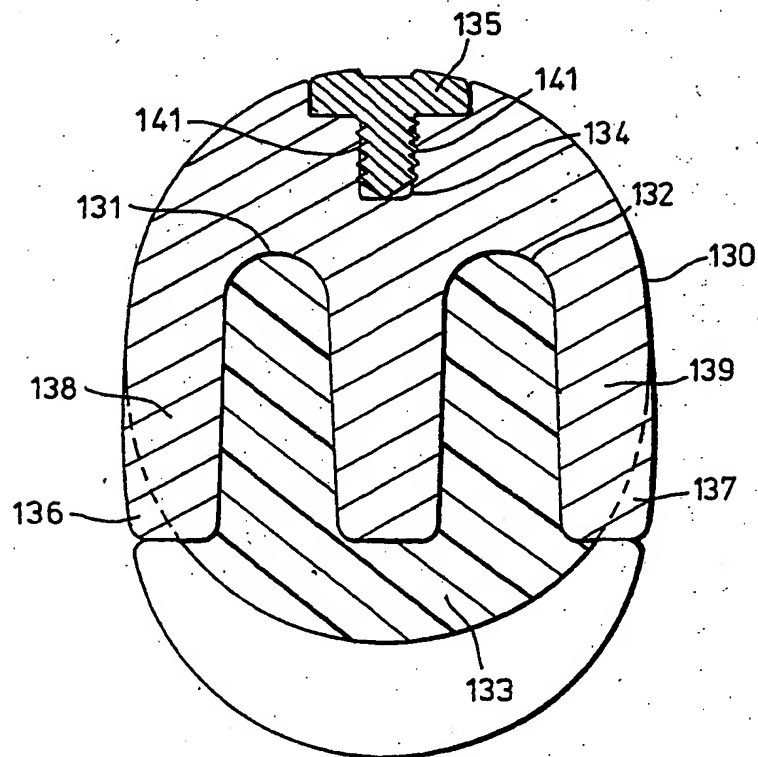


FIG. 22

FIG. 21FIG. 23

## SPECIFICATION

### Steering Wheel

The present invention relates to a steering wheel. More particularly, the invention relates to a steering wheel that is well adapted for economical manufacture as a one-piece molding or casting e.g. of plastics or metal.

It is known to mould steering wheels from plastics or rubber compositions, employing reinforcing interior metal elements. In order to provide the steering wheel with the required strength and rigidity, the molded portions of the rims of the wheels have been of thick, usually oval or circular, cross-section. A disadvantage of this form of construction is that the molding operation is excessively slow, as with thick cross-sections, a considerable time is required for the molding to cool and harden sufficiently for the mold to be opened to permit removal of the molded article therefrom.

Moreover, these procedures have not been well adapted or convenient for the production of a range of wheels of differing styles and colours, as normally an alteration in the appearance of the wheel can be achieved only by employing a fresh set of dies to achieve a molding of a different configuration or surface ornamentation. Especially in the field of manufacture of steering wheels for boats, but also in the manufacture of steering wheels for automotive vehicles, it is desired to offer purchasers a wide range of wheels of distinctive styles, colours, and ornamental trim, as, especially in the field of boat construction, there is a demand for steering wheels of a wide range of styles and appearance. In the past, the procedures employed for the manufacture of these steering wheels have placed limitations on the number of distinctive styles of wheels that may economically be manufactured.

It has now been found that a steering wheel formed with a rim having inner and outer flanges for gripping in the hands, and an interconnecting web, advantageously permits the wheel to be molded or cast with a relatively thin cross-sectional configuration, while still achieving a rim structure having satisfactory strength and rigidity. Moreover, this construction facilitates the attachment of numerous forms of decorative trim to either side of the rim of the wheel, so that with one basic molding or cast form of wheel, a variety of steering wheels of distinctive appearance can be produced, optionally having different forms of trim applied to the front and back of the rim.

The present invention provides a steering wheel of unitary construction comprising an apertured hub portion for receiving and engaging an axially extending steering column, spokes radiating therefrom and formed integrally therewith, and a circular rim portion formed integrally with the spokes, said rim portion comprising inner and outer edge flanges adapted to be gripped on their outer sides by the hand of the user, and an intermediate web interconnecting the inner sides of the edge

65 flanges.

In the preferred form the rim comprises a modified I-section i.e. the web extends generally parallel to and approximately centrally of the general plane of the rim. As compared with other cross-sections of corresponding cross-sectional area, e.g. tubular sections, circular, cruciform or rectangular sections, the I-beam cross-section provides significantly superior properties of compressive and flexural strength. Thus, this form of construction permits satisfactory structural strength of a wheel rim to be achieved utilizing significantly smaller cross-sectional areas, which are thus more economical and efficient as they use lower quantities of materials, and, moreover, as noted above, relatively thin sections may be employed. This has the advantage that it facilitates molding and casting procedures, as, with thinner sections, the time for cooling and hardening of the molding or casting material can be considerably reduced.

Alternatively, the rim may comprise a modified Z-section i.e. the interconnecting web is inclined to the general plane of the rim and extends from adjacent the top edge of the inner side of one flange to the bottom edge of the inner side of the other flange. A channel section rim may also be employed if only one side of the rim is to receive a trim material. Such section is somewhat weaker structurally than the modified I-section or Z-section but may also be adequate.

The rim of the wheel of the invention is also very well adapted for receiving and retaining various forms of tubular, strip-form or channel-section trim that may be secured around the sides of the wheel rim, or may be received and located within the lateral channels defined between the web portion of the rim and the adjacent edge flanges. It also facilitates secondary molding of materials over the rim, e.g. a polyurethane foam may be molded over the rim if a padded rim effect is desired, or alternatively, a polyurethane plastic may be molded into the underside of the rim to provide a soft fingergrip.

The present invention will now be more fully described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a perspective view of one form of wheel in accordance with the invention, and illustrating in exploded form the assembly of elements used to connect the wheel on a steering column;

Figure 2 shows a transverse section through the hub portion of the wheel showing the connecting elements in assembled relationship;

Figure 3 is a plan view of the wheel of Figure 1;

Figure 4 is a section taken on the line 4—4 of Figure 3;

Figure 5 is a section through the rim of the wheel of Figure 3 taken on the line 6—6, illustrating attachment of one form of decorative trim thereto;

Figures 6, 7 and 8 are cross-sectional views similar to Figure 5, illustrating further forms of trim;



Figure 9 is a side view of one form of joiner element used for connecting the ends of trim portions;

Figure 10 is a sectional view through the wheel rim illustrating the joiner element attached on the rim, taken on the line 10—10 of Figure 9;

Figure 11 is a perspective view of a plastics extrusion employed as a connector in the embodiment of Figure 5;

Figure 12 is a sectional view similar to Figure 5 illustrating a further form of trim;

Figures 13 and 14 show plan and side views, respectively, of the trim element employed in the embodiment of Figure 6;

Figure 15 is a sectional view similar to Figure 5 showing a further form of trim;

Figure 16 illustrates a plastics extrudate employed as the connector element in the embodiment of Figure 15;

Figure 17 is a perspective view of a portion of a double channel section rim illustrating in exploded form the assembly of trim to the rim;

Figures 18, 19 and 20 show sectional views of various ways of attaching the trim to the channel section rim;

Figure 21 is a perspective view of a portion of a double channel section rim illustrating in exploded form a further assembly method of trim to rim;

Figure 22 is a cross-sectional view of a rim having double channels on both sides; and

Figure 23 is a cross-sectional view of a further channel section rim wherein a soft polyurethane is shown as secondarily molded into the double channels and a single channel is provided on opposite side of rim for receiving a piece of trim.

Referring to the drawings, the wheel comprises a cylindrical hub portion 21 with an axial splined aperture 22 therethrough. Spokes 23 radiate from the hub portion 21 to a circumferentially continuous rectangular-section rib 24 connected integrally with the inner side of a generally I-section rim 26 having an intermediate web portion 27 parallel to the general plane of the rim 26 and inner and outer circumferential edge flanges 28 and 29.

The inner and outer sides of the flanges 28 and 29 are smoothly rounded and conform to a toroidal surface, thus providing smoothly curved surfaces adapted to be gripped comfortably in the hand.

The embodiment illustrated is adapted to be injection-molded of a high strength plastic, preferably polycarbonate, or to be pressure cast of an appropriate metal or alloy e.g. aluminum, or to be die cast e.g. from zinc alloy or other conveniently castable metals. As noted above, the I-section rim 26 provides excellent strength properties, permitting relatively thin sections to be employed, and thus considerably economizing on utilization of the molding or casting materials. This further permits rapid production of the wheel, as, owing to the thin sections, greatly accelerated setting or hardening times can be achieved.

It may be further noted that in the preferred form, as illustrated, the cylindrical hub 21 is

constituted by thin cylindrical wall, that is integrally joined to the inner periphery of the spokes 23 by radiating generally rectangular vertical fins 31. As may best be seen in Figures 1 and 4, the outer edge of each fin 31 terminates in a thin horizontal disc portion 32 with an axially-extending circumferentially flange 33 and an oppositely-directed thin annular wall 34 which merges at its upper edge with the material of the spokes 23. It may be noted that the wall of the hub 21, the fins 31, the flanges 33 and 34, the disc 32, the spokes 23, and the web portion 27 are of approximately uniform thickness, thus providing for uniformity and speed of hardening of the material during the molding or casting procedure. The form of the spokes 23 as illustrated in the drawings also lends an increased degree of flexibility on impact to the spokes.

Apertures 36 are provided through the spokes 23 and generally arcuate uniformly-spaced curved apertures 37 are provided in the web portion 27 of the rim 26. These apertures 36 and 37 further reduce the amount of materials needed for producing the wheel, and further reduce the time required for cooling and hardening of the material of the wheel during a molding or casting procedure. In the case of the apertures 37, these apertures also facilitate attachment of various forms of decorative trim to the rim 26 of the wheel, as described in more detail later.

Referring to Figures 1 and 2, these show the arrangements employed for connecting the wheel on a steering column. The inner surface of the aperture 22 in the hub 21 is formed with a smoothly and continuously and smoothly curved rotationally symmetrical inner contour for receiving a correspondingly externally contoured adapter 38, which in the embodiment illustrated, is formed with a through key way 39 for receiving a standard steering column 41 having a key 42 on one side. This adapter 38 may be, for example, a metal die casting. Its upper surface is provided with a number of sector-shaped recesses 43 extending part way axially through the adapter 38, and defining generally rectangular-section fins 44 therebetween. The recesses 43 serve to reduce the quantity of material required for the adapter 38, while still permitting an adequate strength of connection between the wheel and the steering column 41. The lower side of the adapter 38 includes a transversely extending continuous edge flange 45 which, in the assembled condition as shown in Figure 2, abuts the lower side of the hub 21. In assembling the steering wheel on the column, a threaded upper end of the column 41 is passed through a retaining washer 46 that rests on the upper side of the wheel hub 21 and the adapter 38, and the assembly is secured together with a lock washer 47 and nut 48 threaded securely on the upper end of the column 41.

The curved contour of the interengaging spline surfaces of the hub 22 and the adapter 38 provides a secure engagement of the wheel on to the steering column while avoiding sharp angles

and corners that are liable to concentrate stresses that might lead to failure of the material of the hub or of the adapter. Owing to the symmetry of the splined arrangement, assembly of the wheel on to the steering column is greatly facilitated, as, irrespective of the angular position of the key 42 on the column 1 or other rotationally asymmetric column, with the steering gear of the boat or vehicle in the straight ahead position, the wheel can be located on the adapter 38 in its central forward position and can be attached to the adapter without needing to carry out any adjustment of the steering gear.

This arrangement also has the advantage that the wheel may be connected securely to the column 41 by tightening only one nut 48, and the arrangement lends itself to connection to various different forms of steering column 41, as various forms of hub adapter 38 may be provided similar to the adapter 38 except for the configuration of passageway, key way 39, or other internal recess adapted for receiving the upper end of the steering column 41.

As mentioned above, it is a further advantage of the configuration of the I-section rim 26 of the wheel that it facilitates attachment of various forms of decorative trim onto the wheel.

One preferred procedure is to employ as the trim an extruded length of hollow-section plastic or metal trim material that has been extruded employing a helical extrusion technique or other extrusion technique that forms the extrudate with a continuous lateral curvature or bias, with a radius of curvature conforming to the radius the rim 26 of the wheel. Such extrudate may be severed into approximately circular pieces that will approximate to the shape and size of the rim 26 of the wheel when applied thereto.

By way of example, Figure 5 shows on each side of the rim of the wheel a metal, or preferably plastics, generally channel-section extrudate trim 49. The inwardly-inclining walls 51 of the channel are provided at their upper sides with a rib 52, and a continuous raised central ridge 53 extends along the channel bottom of the trim 49. As illustrated in Figure 5, similar lengths of trim 49 are fitted to the rim 26, each piece being received in the channel defined between the intermediate web portion 27 and the inner sides of the inner and outer edge flanges 28 and 29.

These portions of extrudate are held securely in place within the channels of the rim 26 by snap-fastening connectors 54 that are passed through the rectangular apertures 37 in the wheel rim and lock onto the inner sides of the trim pieces 49.

Figure 11 illustrates a length of plastic or metal extrudate 56 that, when severed into lengths corresponding to the length of the apertures 37, serve as the connectors 54. This linear extrudate 56 has on each side adjacent its central portion a recess 57 that snap-fastens onto and grips the sides of the aperture 37 as shown in Figure 5. On each side adjacent the outer ends of the extrudate, inwardly-slanted angular rib sections 58 are formed. As can be seen in Figure 5, in the

assembled condition these ribs engage with the ribs 52 on the inner sides of the channel walls 51 of the trim 49. In assembling the wheel, a number of the connectors 54 sufficient to provide a secure location of the trim portions on to the rim 26 are snapped into place through the apertures 37 in the rim 26. Typically, about six of the connectors 54, spaced regularly around the periphery of the rim 26 will be employed. On each side of the extrusion 56, there is a recess 59 that receives the central ridge 53 of the trim 49, this ridge 53 tending to splay outwardly the portions of the connector 54 bearing on the ribs 58, so that these are retained in secure engagement with the ribs 52 of the trim 49.

In order to conceal the ends of the pieces of trim 49, and maintain the latter more securely in place, a joiner element as illustrated in Figures 9 and 10 may be applied around the rim 26. The joiner element illustrated comprises two similar semi-cylindrical plastic shells 61 provided with a central projection 62 conforming to the contour of the channel formed by the intermediate web 27 and the side flanges 28 and 29 of the rim.

The element 61 is adapted to be welded ultrasonically onto the material of the rim 26, and the inner side of each shell 61 is formed with an ultrasonic energy-directing median rib 63. In assembling the wheel, the two shells are placed around the rim 26 as illustrated in Figure 10, with projection 62 interposed between the adjacent ends of each piece of trim 49 and are welded in place employing an ultrasonic horn applied on the exterior of the shell 61. This fuses the material of the rib 63 and welds the shells securely in place on the rim 26 as shown in Figure 10 and in broken lines in Figure 5.

Figure 6 illustrates a further form of trim utilizing two identical molded rings 64 illustrated in Figures 13 and 14. At spacings around the ring 64, corresponding to multiples of the spacing of the rim apertures 37, namely at least twice the spacing of the apertures 37, the ring 64 is formed with pairs of fingers 66 with outwardly extending gripping edges 67, so that the two rings, arranged with their projections 66 staggered with respect to one another can be snap-fitted onto the rim 26 with the projections 67 snapping through the rim apertures 37, as shown in Figure 6. Around the periphery of each ring 64 intermediate the sets of fingers 66, there are central ridges 68 which add reinforcement to the ring. The ridges are interrupted by gaps 70 to permit the fingers 66 of the opposite ring to be received through the apertures 37.

Figure 7 shows a further form of trim comprising an extruded or molded plastics foam interior lining 69 with a continuous outer plastics skin 71. The trim has a continuous opening 72 along one side permitting the trim to be applied around the circumference of the rim 26, with the edges of the trim adjacent the opening 72 fitting onto the circumferentially continuous rib 24 on the inner side of the rim 26, as shown in Figure 7. The adjoining ends of the trim may be concealed

employing joiner elements as illustrated in Figures 9 and 10, the ends of the trim being received in compressed condition within the open-ended cylinder formed by the two semi-cylindrical shells 61 of the joiner.

Figure 8 illustrates a further form of trim comprising an open-sided continuous tubular metal or plastics extrusion 73 which has sufficient resiliency to permit it to be assembled by forcing it over the rim 26 so that the edges of the opening 74 in the extrusion engage on the inner side of the curved surface of the inner flange 28. The extrusion 73 may be formed integrally with internal spacer ribs 76 serving to space the interior of the extrusion 73 from the exterior of the flanges 28 and 29. The adjacent ends of the extrusion in the assembled condition on the wheel may be concealed within a joiner element similar to that illustrated in Figures 9 and 10, having shell portions 61 formed with internal dimensions sufficient to accommodate the material of the ends of the extrusion 73.

Figure 12 illustrates a further embodiment wherein a metal channel 77 is inserted on each side of the rim in the channel formed between the edge flanges 28 and 29 and the web 37. In the preferred form, these channels 77 are each formed as an endless metal ring by stamping from sheet metal. Alternatively, they may be roll-formed as split metal rings, or may be extruded approximately ring-shape sections. The rings 77 fit snugly within the channelled profile of the rim 26, and can serve to reinforce the rim if this is required if the wheel is itself molded or cast from a low strength material, e.g. a low strength plastics material. In the embodiment illustrated, the upper edge of each side of the channel 77 is rolled over to form a smooth-surfaced edge bead 78, and before inserting the rings into the wheel rim the bottoms of the channels are punched and pressed to provide tubular collars 79 at such spacings and of such diameter that these can be inserted through the rim apertures 37 and that the collars of one channel 77 can be inserted into the collars 79 of the other channel, as shown in Figure 12. The ends of the innermost collars are then turned over, e.g. by riveting, to form an outwardly flared portion, as shown at 81 in Figure 12, thus retaining the two channels 77 in securely engaged back-to-back relationship on rim 26. Extruded or molded trim portions may then be snapped into the metal channels to be retained by the bead 78. For example, in Figure 12, extruded trim portions 82 are illustrated having a foamed interior and a continuous plastics external skin and having edge grooves 83 into which the edge beads 78 snap to retain the extrusions 82 on the rim 26 when the extrusions 82 are pressed home into the metal channel 77.

If an extruded section or split ring is employed as the trim piece 82, a joiner ring similar to the elements illustrated in Figures 9 and 10 may be employed to conceal the adjoining edges of the severed pieces of the extrusion. Alternatively the extruded section or split ring may be butt welded

to form an endless ring before it is inserted into the wheel rim.

Figures 15 and 16 illustrate a further embodiment similar in principle to Figure 5, having extruded trim pieces 84 received within the channels of the I-section rim 26. On the outer side of the pieces 84, a decorative inlay 86 is attached. This may be a bright metal or woodgrain strip or may be a strip of plastics contrasting in color to the color of the main extruded piece 84, or the major face of the piece 84 may be woodgrain, with edges 86 being a metallic strip inlay, or in a contrasting color.

The pieces 84 are secured to the rim 26 employing connector pieces 87 inserted through the rim apertures 37. These connectors 87 are short lengths severed from an extrusion as illustrated in Figure 16 having a recess on each side adjacent the centre 88 for engaging the periphery of the rim aperture 37 and barbed outer portions 89 which in use are received within corresponding recesses in the trim portions 84, as illustrated in Figure 15.

It will be appreciated from the above that the basic I-section of the rim 26 lends itself very readily to the reception of various styles of decorative coverings, reinforcing sections, or inserted trim pieces. It thus permits combinations of materials to be used to achieve improved comfortableness of the wheel in the hands of the user and to improve the appearance and strength of the wheel rim. Without limitation thereto, it may be mentioned that, for example, metal channels similar to the channels 77 illustrated in Figure 12 may be employed of varying cross-sections in order to achieve a desired degree of reinforcement of the wheel. The double-channelled I-section permits, for example, a soft insert to be applied in the channel on the back of the rim, which insert may include finger grips, and an insert of relatively hard material may be applied in the front channel of the rim, and this latter may be decorated in varying styles, e.g. it may be of a woodgrain finish with a bright metal stripe inlay on each side of the woodgrain portion.

It may further be noted that instead of using mechanically interlocking snap-fastening arrangements or the like to affix the trim or covering piece on the wheel rim, decorative rings and other trim pieces may be attached to the rim of the wheel by glueing using, for example, a contact cement, and this may be applied in a manner similar to that employed in affixing the conventional bumper strips which are applied on automobile doors and fenders. In such case, the web portion 27 of the rim 26 may be continuous, without having the apertures 37 therein.

Moreover, the form of wheel rim as illustrated lends itself to further processing by injection-molding a softer or a harder plastics material into one or more of the channels of the I-section rim 26. In such case, the injection-molded material may pass through the apertures 37 of the rim, which thus serve as a key locking the injection-molded material in place.

Likewise, the channel section rim illustrated in Figures 17 through 23 may be subjected to a secondary molding step in which a softer plastic may be injected into the channels.

Referring more specifically to the channel section rims which constitute an alternate embodiment of the invention, Figure 17 shows a portion of a double channel section rim 100 which is preferably made of a high strength plastic, and has channels 101 and 102 opening upwardly to receive a piece extruded trim 103. The underside of the rim 100 is contoured with smoothly curved alternating undulations which constitute a fingergrasp for the steering wheel.

There are a number of possible ways to attach the trim 103 to the rim 100, and examples are shown in Figures 17 through 21. As seen in Figure 17, the central ridge 104 of the rim 100 may be equipped with a series of metal clips 106 which are held in place on the ridge 104 by inwardly protruding barbs 107. The clips 106 are also provided with outwardly protruding wings 108 which engage and retain longitudinal ribs 109 in the central channel 111 of the trim 103. The longitudinal ridges 112 and 113 of the trim 103 are inset from the edges 114 and 115 thereby providing two outwardly extending flanges 116 and 117 which extend the outer curvature of the trim 103 to correspond to the general curvature of the cross-section of the assembled rim. The longitudinal ridges 112 and 113 need only be of sufficient height to insure secure engagement of the ribs 109 with the wings 108 on the metal clips 106, as shown in Figure 18. This arrangement allows for the provision of transverse structural members 118 to be molded into the channels 101 and 102 at regular intervals to provide reinforcement for the outer walls 119 and 120.

The trim 103 may alternatively, be simply glued in place on the rim 100 as shown in Figure 19. The outer sides of the ridges 112 and 113 may be stepped inwardly toward their bottom portion to provide a convenient area 121 for the application of glue 122.

As shown in Figure 20, the trim extrusion may have a smoothly curved central channel 111. The metal clips 106 are provided in this embodiment with both outwardly and inwardly directed barbs 107 which engage the central ridge 104 of the trim 100 as well as the inner walls of the ridges 112 and 113 of the trim 103 upon assembly.

An additional method of joining the trim 103 to the rim 100 is shown in Figure 21. In this embodiment the central ridge 104 of the rim 100 is provided with a metal covering 123 which is held in place on the ridge 104 by inwardly protruding barbs 124. The edges 125 and 126 of the covering 123 are bent outwardly to form a continuous lip at either side of the central ridge 104 for engaging inwardly directed flanges 127 and 128 on the ridges 112 and 113 of the trim 103.

It will be appreciated that the rim 100 may comprise several different channel section

variants. For example, Figure 22 shows a rim 129 having double channels on either side for receiving trim extrusion or secondary moldings.

A final important embodiment of the channel section rim variation of the present invention is shown in Figure 23. Channel section rim 130 is oriented oppositely from the orientation of channel section rim 100 described previously. Thus, a rim 130 of high strength plastic is provided so that the channels 131 and 132 open downwardly to receive a softer plastic portion 133 injected into a secondary molding step. The rim 130 is also provided with an upwardly opening channel 134 for receiving a trim element 135.

By utilizing injection molding techniques more fully, the wheel produced in embodiment of the invention has several advantages over previously described embodiments. Initially, the channel section rim 130 is molded of high strength plastic and subjected to vapor polishing to provide a smooth finish to the material suitable for the finished product. The rim 130 is then subject to a secondary molding step in which self-skinning polyurethane is injected into the channels 131 and 132 to provide a soft fingergrasp for the underside of the steering wheel.

The flexibility of the injection molding technique allows for the addition of this irregularly shaped fingergrasp portion 133 to the rim 130. The rim 130 is also molded with undulating areas 136 and 137 along the outer lower portion of the outer walls 138 and 139. These undulating areas 136 and 137 interface with the corresponding undulations of the soft plastic fingergrasp portion 133. As the soft polyurethane of the secondary molding step bonds under the heat and pressure of the procedure to the hard plastic of the rim 130, a unitary structure is achieved.

The wheel may be completed with the addition of a decorative trim 135 inlaid into the upper channel 134. The trim 135 is prepared by an extrusion method, and is joined to the rim 130 by such means as engaging triangular section ribs 141 with the walls of upper channel 134. In addition or as an alternative method, a bonding agent may be used to fix the trim 135 in the channel 134.

As with the previously described channel section rim 100, the rim 130 may be provided with transverse structural members (not shown but corresponding to the members 118 in the rim 100) molded into the downwardly opening channels 131 and 132 to provide reinforcement for the outer walls 138 and 139. The integrity of the double channel section is thus maintained by these transverse structural members as they provide buttressing of the outer walls 138 and 139 against inward collapse.

The finished steering wheel of this last embodiment as shown in Figure 23, has the distinct advantage of providing a wheel with a smoothly polished upper rim surface which allows for quick handling, and additionally providing a spongy fingergrasp portion at the underside of the

wheel allowing the wheel to be held comfortably and giving good frictional engagement of the driver's fingers with the wheel.

Normally, if the wheel as illustrated is molded as an integral plastics molding, it need not be coated with any material, as the plastics material itself may be satisfactory as to its appearance and its comfortableness in the hands of the user. It may be noted, however, that a molded or cast plastics wheel may be covered with an injection-molding of a lower melting point plastics. For example, a molded high melting point plastics wheel as illustrated in the accompanying drawings may be covered wholly or in part with a soft vinyl or urethane covering in a subsequent injection-molding operation.

Where the wheel is cast from a metal or alloy, the wheel may be provided with an attractive and durable surface finish coating, e.g. a bright or black chrome-plated finish. Moreover, the wheel may be painted with various colors and/or textures of paints, or may be coated with various coating materials, e.g. it may be plastisol coated with soft vinyl plastics.

It will be noted that with the preferred form as illustrated in Figures 1—17, the load applied by the user's hands on the outside of the rim of the steering wheel is received directly by the material of the flanges of the I-section wheel rim, especially by the outer flange 29, with at the most only a thin shell or covering extending over the rim 26 of the wheel, with this relatively thin covering resting in load-transmitting relationship on the outer side of the outer flange 29. Thus, as the wheel is formed as an internal molding or casting, the load exerted by the hands of the user is transmitted direct to the remaining elements of the wheel and to the steering column whereas in the known form of wheels referred to earlier, this has not been the case as the forces received on the molded plastics rim of the wheel have been transferred to the internal metal reinforcing elements embedded deep within the plastics of the rim, and these forces have been transmitted through the metal to the spokes and the hub of the wheel. Similar forces act on the channel section rims of Figures 17 through 23, and although the strength of these channel section rims may be somewhat less than that of the I-section rims, the additional advantages mentioned in relation to the channel section rims may make them preferable from a commercial standpoint.

#### Claims

1. A steering wheel of unitary construction comprising an apertured hub portion for receiving and engaging an axially extending steering column, spokes radiating therefrom and formed integrally therewith, and a rim portion formed integrally with the spokes, said rim portion comprising inner and outer edge flanges adapted to be gripped on their outer sides by the hand of the user, and an intermediate web interconnecting the inner sides of the edge

65 flanges.

2. A wheel as claimed in claim 1 formed as a one-piece molding of plastics material.

3. A wheel as claimed in claim 1 formed as a one piece metal or alloy casting.

4. A wheel as claimed in claim 1, wherein said flanges have toroidal outer sides.

5. A wheel as claimed in claim 1 in which the web extends parallel to the general plane of the rim.

6. A wheel as claimed in claim 1 in which the web extends approximately centrally of the flanges.

7. A wheel as claimed in claim 1, wherein the web portion of the rim is interrupted by spaced apertures.

8. A wheel as claimed in claim 7, wherein the apertures are generally rectangular.

9. A wheel as claimed in claim 1, wherein the hub comprises a radially outer portion molded integrally with the spokes, and a radially inner portion connected integrally with the outer portion by radial fins defining spaced apertures therebetween.

10. A wheel as claimed in claim 1, wherein the hub defines a central aperture with uniform regularly circumferentially spaced axially-extending splines.

11. A wheel as claimed in claim 10, wherein the splines have a smoothly curved cross-section.

12. A wheel as claimed in claim 1 including a decorative trim approximating and applied around the circumference of the rim, the trim comprising an arcuate length of tubular section sleeve having a continuous longitudinal opening extending along one side, said sleeve extending over the outer sides of said inner and outer web flanges with the edges of the opening engaging the outer side of the inner rim flange.

13. A wheel as claimed in claim 12, wherein said sleeve comprises a continuous outer skin and an inner plastics foam lining in contact with the material of the rim.

14. A wheel as claimed in claim 12 or 13, wherein said sleeve is a continuously laterally curved extrudate.

15. A wheel as claimed in claim 12 or 13 including a joiner element for gripping and securing adjoining ends of the trim, the joiner element comprising two semi-cylindrical shells each provided with a central projection conforming to the contour of the web and inner sides of the flanges of rim, said shells being welded together on said rim.

16. A wheel as claimed in claim 1 including decorative trim comprising trim means received in a channel on each side of the rim defined between the web and the edge flanges.

17. A wheel as claimed in claim 16, wherein the trim means comprise an arcuate length of extrudate received in each channel and conforming to the circumference of the wheel.

18. A wheel as claimed in claim 16, wherein the web of the rim is provided with uniform regularly spaced apertures therethrough and



including connecting means passing through the apertures and securing said trim means in its respective channel.

19. A wheel as claimed in claim 18, wherein the trim means and the connecting means have co-operating snap-coupling points therein.

20. A wheel as claimed in claim 19, wherein the connecting means include a central snap-coupling co-operating with the edge of the aperture in the web portion of the rim and locating the connecting means therein.

21. A wheel as claimed in claim 19 or 20, wherein the connecting means comprise a short length of extrudate of uniform cross-section passed through said apertures in the web portion of the rim.

22. A wheel as claimed in claim 18, wherein the trim means comprise two similar endless rings each provided on one side with connecting means comprising projections adapted to pass through and grip on the periphery of an aperture in the web portion of the rim, the projections being spaced uniformly apart at a spacing at least twice the spacing of the apertures in said web portion.

23. A wheel as claimed in claim 18, wherein the trim means comprise two similar metal channels each disposed in a channel in said rim, and connecting means connecting the adjacent bottoms of said metal channels.

24. A wheel as claimed in claim 23, wherein the connecting means comprise integral tubular collars stamped in the bottom wall of each metal channel and passing through the apertures in the web portion, at least selected ones of said collars having their lower edges out turned and engaging within a corresponding collar of the other channel on the opposite side of the rim.

25. A wheel as claimed in claim 23, wherein the upper edges of the channel walls are turned inward to form an edge bead for engaging a resiliently deformable auxiliary trim piece received in the metal channel.

26. In combination, a wheel as claimed in claim 1 and an adapter having a rotationally symmetrical outer surface engaging within the apertured hub portion of the wheel and a rotationally asymmetric inner surface for engaging with a steering column.

27. The combination of claim 26, wherein the adapter is provided with means whereby it can be connected between the wheel and the column by a single axial nut.

28. The combination of claim 26, wherein the outer surface of the adapter has a continuous smooth curvature.

29. A steering wheel of unitary construction and formed as a one piece molding of plastics material comprising an apertured hub portion for receiving and engaging an axially extending steering column, spokes radiating therefrom and formed integrally therewith, and a rim portion formed integrally with the spokes, the rim portion having one or more longitudinal channels, each channel opening either upwardly or downwardly

between side walls of the rim.

30. A wheel as claimed in claim 29, wherein the hub comprises a radial outer portion molded integrally with the spokes, and a radial inner portion connected integrally with the outer portion by radial fins defining spaced apertures therebetween.

31. A wheel as claimed in claim 29, wherein the hub defines a central aperture with uniform regularly circumferentially spaced axially-extending splines.

32. A wheel as claimed in claim 31, wherein the splines have a smoothly curved cross-section.

33. A wheel as claimed in claim 29 including a decorative trim approximating and applied around the circumference of the rim, the trim comprising an arcuate length of extruded plastic having on one side continuous means for engaging the channel portion of the rim, the other side being arcuate in conformity with the general outer shape of the rim cross-section.

34. A wheel as claimed in claim 33, wherein the rim is of a double channel section having a central ridge separating the channels, the trim having two longitudinal ridges separated by a central channel, said ridges and channel of the trim adapted to engage said channels and ridge of the rim, and means for securing the trim to the rim.

35. A wheel as claimed in claim 34, wherein the trim is secured to the rim by means of regularly spaced metal clips affixed by barbs to the top curvature of the central ridge of the rim, the clips also having outwardly extending wings for engaging inwardly extending ribs located on the oppositely facing walls of the central channel of the trim.

36. A wheel as claimed in claim 34, wherein the means for securing the trim to the rim comprises a bonding agent placed between engaging surfaces of the trim and the rim.

37. A wheel as claimed in claim 34, wherein the means for securing the trim to the rim comprises regularly spaced metal clips affixed by barbs to the top curvature of the central ridge of the rim, the clips also having outwardly extending barbs for engaging the smooth walls of the central channel of the trim, the curvature of the said central channel conforming in shape approximately to the curvature of the central ridge of the rim.

38. A wheel as claimed in claim 34, wherein the means for securing the trim to the rim comprises a continuous metal clip affixed by barbs to the top curvature of the central ridge of the rim, the clip having outwardly bent edges extending away from the walls of the central ridge thereby forming longitudinal lips one on either side of the clip for engaging inwardly extending flanges located one on either side of the opening of the central channel of the trim.

39. A wheel as claimed in claim 29 having two symmetrically disposed downwardly opening channels and one upwardly opening channel in the rim portion, the downwardly opening

channels being injected with a molding of softer sponge-like plastic as compared to the plastic of the rim itself, the soft plastic being molded in the form of a continuous finger grip for the wheel, the upwardly opening channel adapted for receiving a decorative trim.

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40. A wheel as claimed in claim 39, wherein the soft sponge-like plastic which comprises the finger grip on the underside of the wheel is a self-skinning polyurethane plastic.
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41. A wheel as claimed in claim 39, wherein

the upwardly opening channel of the rim is roughly of T-section, the trim having a central longitudinal ridge with triangular section ribs extending outwardly to engage the walls of the channel of the rim.

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42. A wheel as claimed in claim 39, wherein the trim is secured in the upwardly opening channel of the rim by a bonding agent.

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43. A steering wheel substantially as hereinbefore described with reference to any of the accompanying drawings.